UNIVERSITY OF WASHINGTON

ARBORETUM BULLETIN

SPRING 1973

PRESIDENT'S MESSAGE

I was happy to receive the following letter from Dr. Charles E. Odegaard, President of the University of Washington, and am pleased to share it with the Foundation members. The Foundation deems it most fortunate that the University has had a President who has had an active interest in the welfare of the Arboretum. We will miss his leadership and wish him continued fulfillment in his retirement.

UNIVERSITY OF WASHINGTON
SEATTLE, WASHINGTON 98195

Office of the President

March 20, 1973

Mr. John A. Putnam
President, Arboretum Foundation
9026 N.E. 14th Place
Bellevue, Washington 98004

Dear Mr. Putnam:

I want you to know how very much my colleagues at the University of Washington who have been professionally and administratively involved in Arboretum affairs appreciate the efforts you and your associates have been making to try to preserve the possibility for a distinctive scientific arboretum and botanical garden appropriately handled and used within Washington Park as one element within the City of Seattle park system. While I personally, obviously, can lay claim to no professional expertness in horticultural matters, I do feel as a citizen the consequences of the work of those who have evidenced a special interest in arboretum and botanical garden affairs and through such organizations as yours in cooperation with the University made it possible for each of us to enjoy a rare attractive kind of green space and at the same time to learn something about plants for our personal enrichment.

While we do not know yet the outcome of the recent discussions as far as the decisions of the City of Seattle are concerned, I do indeed hope that a basis for our continuing collaboration can be found which will permit Washington Park to shelter a very unusual facility both for public enjoyment and for an increase in knowledge about plantings such as are to be found in the arboretum and botanical garden. Surely you and your associates have done all possible to help bring about such a solution.

With appreciation,

Sincerely yours,

Charles E. Odegaard

Charles E. Odegaard
President

CEO:ml

John A. Putnam

THE ARBORETUM BULLETIN

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THE UNIVERSITY OF WASHINGTON

Arboretum bulletin

VOLUME XXXVI, NUMBER 1

Spring, 1973

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COVER PHOTO: *Magnolia sargentiana var. robusta*
Photo: Joseph P. Butler

The Hazards of Genetic Uniformity in Plants

*by REINHARD F. STETTLER**

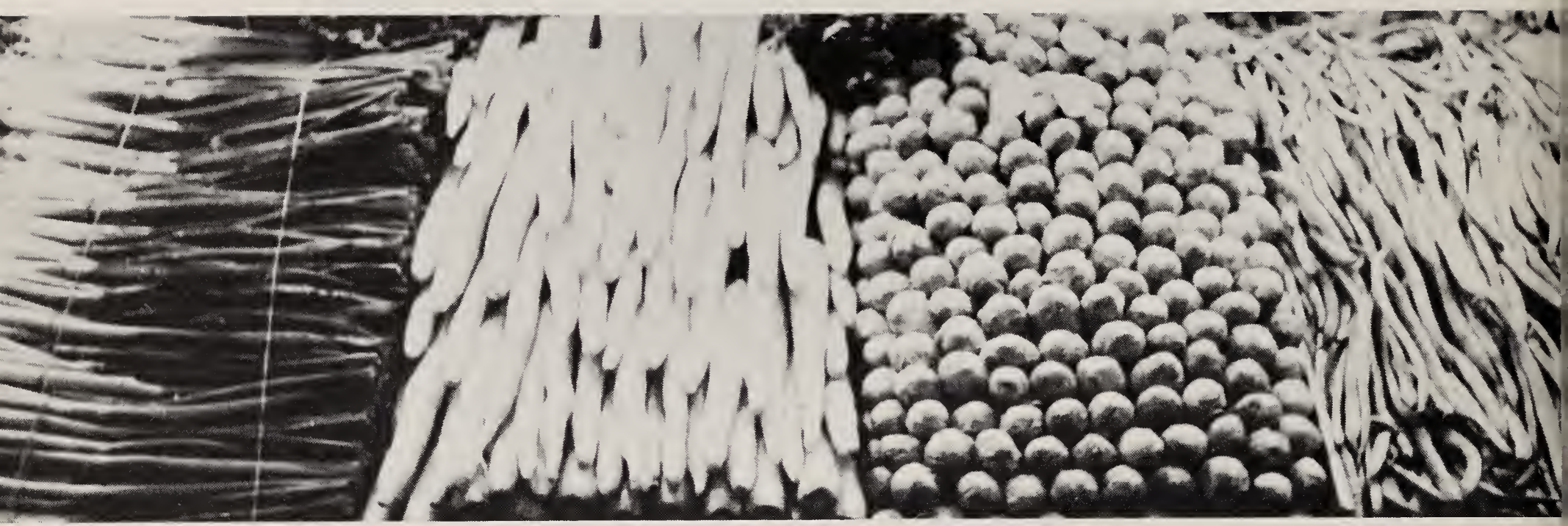

Photo: Joseph P. Butler

Have you ever seen thousands of elite troops perform on a parade ground? If so, you probably experienced an ambivalent sensation: on the one hand you were impressed by the precision and uniformity of form and movement in these long columns of soldiers; on the other, you had a certain sensation that there was something unnatural, counter-biological, in such automated behavior of human beings. And if I had to make any prediction about this sensation I would say that its intensity was, among other things, proportional to the number of performers on the parade ground. In other words, while you may accept a small drill team as something entertaining, you are uneasy about thousands of performers engaging in the same synchrony.

Is there somewhere in our body a physical endowment, an *Ur-Masse,* that serves as a check mechanism setting off a buzzer whenever we violate our biological code? If so, it is not entirely reliable, or at least not equally so in all of us. Or else most of us would be perturbed by the uniformity of fruit and vegetables that we encounter in any supermarket today: apples, tomatoes, oranges, corn ears, salad heads, all are paraded to display their remarkable repeatability in size, form, color, and ripeness. And indeed, their uniformity is remarkable. In fact, we will immediately notice undue variability and will attribute it to inadequate quality control.

Now, if there is any difference between soldiers and corn plants, it should make our analogy even more alarming. While a soldier leaves his group identity on the parade ground and spends his evening as an individual, to be a corn plant is a full-time proposition. Or in other words, while stereotype in the case of the soldier is temporary and largely achieved through the *environmental* molding of basically variable genotypes, in the case of the corn plant it is permanent and largely obtained via *genetic* uniformity. Why should this cause alarm? Because genetic uniformity also means uniformity in the resistance or susceptibility to pathogens and insects. And since many plant parasites have markedly shorter life cycles than their hosts, they can rapidly evolve new virulent

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*Dr. Stettler is Associate Professor of Forest Genetics at the University of Washington, College of Forest Resources, and a member of the Bulletin Editorial Board.

strains capable of exploiting a widely available uniform substrate. This is precisely what has happened every few years in many different crops, frequently with disastrous economic impact. So much so that in 1970, triggered by the southern corn blight, the National Academy of Science appointed a study committee of experts to broadly examine the general issue of vulnerability of crops. The report of this committee has been recently published[1]. It tells a disturbing but plausible story and makes recommendations that, hopefully, will have a significant impact on agricultural practice, policy, and research. It singles out one factor that seems to be the common denominator in most recurring crop epidemics: genetic uniformity.

Let us then briefly examine how natural selection operates, how man's selection compares with it, and how the two may interact under certain circumstances to bring about plant epidemics. And let us finally consider how this affects us as biologically aware citizens.

Natural Selection

The concept of natural selection, introduced by Darwin in 1859, and hotly debated at that time, is now accepted as an integral part of organic evolution. However, what initially was suggested by the maxim "survival of the fittest" has in the meantime been more thoroughly analyzed and has revealed a fairly sophisticated machinery. The vignette of the triumphant stag standing over his dead opponent no longer seems adequate to portray the subtle process by which certain genes are passed on from one generation to another in greater numbers than others.

Selection implies choice, the availability of alternatives. This seems almost too trite to deserve attention. Yet, it touches on a fundamental law concerning the genetic basis of natural selection. This law was first convincingly demonstrated in the early 1900's by the Danish scientist, Johannsen, in a series of simple but rigorous selection experiments involving the common garden bean[2]. Starting with a mixture of seed from many different plants, Johannsen selected for different seed weights and found that in the first generation progenies from heavier seeds in general had greater average seed weight than progenies from lighter seed. After a few generations, however, the differences stabilized and could not be further increased by selection. In other words, selection had initially separated the mixed lot into "pure lines" each of which thereafter could not be broken down further into sub-lines because it was genetically uniform. Apparently then, selection became ineffective as soon as all genetic variation had been exhausted.

What Johannsen did with his beans was essentially a model, albeit a grossly simplified one, of what is going on in nature. The effectiveness of natural selection is proportional to the amount of natural variation available. Hence, it is not surprising that most evolutionarily successful organisms — those that have been able to adapt to the changing environment — have mechanisms by which they can release a certain amount of genetic variation, generation after generation. This ensures that in the face of changing living conditions, a certain fraction of offspring will be pre-adapted and will provide continuity for the species.

One mechanism that generates variability is *sexual reproduction.* If its ubiquity is a measure of significance it must have been one of the most significant inventions in evolutionary history, because it is found throughout the major phyla of the plant and animal kingdoms. Characteristically, it provides two shuffling processes, *meiosis* (the formation of sex cells) and *fertilization* (the fusion of sex cells), in which gene associations are broken up more or less at random, repackaged, and recombined into new individuals, many of them uniquely predisposed to meet new challenges.

The power of this recombination process can be portrayed by a simple calculation for the correctness of which you have to take my word. Under a set of rather straightforward assumptions, two parent plants that differed by no more than 100 genes (a small fraction of their genetic endowment) could produce 1.6×10^{57} different offspring if recombination was completely at random, a truly astronomical number.

Now you may wonder whether so much variation may not be too much. Suppose our

two parent plants were very well adapted to the environment in which they lived. More than likely, their immediate offspring would experience a very similar kind of environment rather than a drastically changed one. Thus, it would seem extravagant to channel so much reproductive potential into new random concoctions, most of which would turn out to be misfits anyway. Would it not seem more sensible to produce progeny, the bulk of which showed much resemblance to the parents, whereas only a small fraction would constitute new experiments? In such a manner both demands could be met, the former assuring immediate adaptation, and the latter providing for long term evolutionary success. Although such teleological reasoning seems hardly within the power of a flower head, most plants have indeed adopted such a mixed strategy, setting certain constraints upon recombination and often combining sexual reproduction with a sexual reproduction to exploit both homogeneity and heterogeneity in space and time. Or, in other words, those species that were either too uniform or too variable ended up in evolutionary blind alleys.

Man's Selection

Man, the domesticator, has applied selection pressures of his own to many plants and animals and over the years has completely reshaped their morphology, anatomy, physiology and genetics. First intuitively, later more deliverately and scientifically, he lengthened corn ears and shortened wheat stalks, got more seed in poppies and fewer in oranges, made bulls fiercer in Spain and tamer in Texas. And to safeguard his investments, he protected them against pests and diseases.

If there was a common goal in all these diverse strategies it was *predictability.* To this end, all unpredictable factors were minimized. This called on the one hand for homogeneous races or hybrids with predictable requirements from the environment, and on the other, for predictable and unform environments. With a bit of systematic testing you could determine the optimal recipe of cultivation, nutrition and protection of a given race and push it to maximum performance. Once tested, this could be repeated on a large scale, provided all steps of the recipe were faithfully followed and all ingredients remained the same. Under favorable circumstances, even the vagaries of weather could be eliminated and replaced by a uniform greenhouse climate. Large-scale culture of a predictably uniform product allowed mechanization in harvesting and processing and ultimately reduced the market price. Predictability of the produce allowed the producer to influence consumer expectations through advertisement. And finally, the consumer became used to a uniform product of predictable quality.

In the process, productivity has been raised several-fold, allowing man to feed more mouths with less land. However, as so many other advances in our finite system, this boon has not come free. In fact, it has exacted a price, the amount of which seems acceptable to some scientists, exorbitant to others. However, all agree that the price is difficult to assess in that it is a composite of many different currencies. How do you measure, for example, the systematic depletion of genetic variation through the replacement of natural populations with synthetic populations? And what is the appropriate time span for which this loss should be prorated?

In the absence of a commonly accepted index it may be at least useful to examine some statistics that portray the degree of genetic uniformity in a few of our major crops. They are taken from the NAS Study[1] and are presented in Table 1. We can see there, for example, that in the case of cotton, 53 percent of the total acreage, or approximately six million acres, are planted to no more than 3 major varieties. In other words, one single genetic variety may cover as much as two million acres. The figures are even more extreme for corn and assume a truly alarming dimension if we realize that most corn varieties in 1969 shared the same identical cytoplasm, the "Texas male sterile cytoplasm", which had been carefully built into them for the purpose of breeding efficiency. It was precisely this uniform cytoplasm that proved to be the failing link when in 1970 a new, virulent strain of the corn blight fungus, *Helminthosporium maydis,* spread through the U.S. cutting down corn yields by as much as 50 percent in some southern states.

Table 1: Acreage of Some Major U.S. Crops and Percent of Acreage Devoted to Major Varieties (*1969 Figures)

Crop	Acreage (Million)	Number of Major Varieties	Percent Acreage Devoted to Major Varieties
Bean, dry	1.4	2	60
Bean, snap	0.3	3	76
Cotton	11.2	3	53
Corn	66.3	6	71
Peanut	1.4	9	95
Peas	0.4	2	96
Potato	1.4	4	72
Soybean	42.4	6	56
Wheat	44.3	9	50

*From "Genetic Vulnerability of Major Crops", NAS, 1972

Evidently, depletion of genetic variability has reached major proportions in our agricultural crops. The question is: How does genetic uniformity contribute to the outbreak of epidemics?

Uniformity and Epidemics

It should be obvious that a densely packed host population, all of identical genotype and all of which happen to be sensitive to a particular pathogen, is the ideal situation for such a pathogen to spread and possibly approach epidemic proportions. What frequently is less well understood is how an initially resistant host all of a sudden turns out to be sensitive.

Typically, this reflects not so much a change in the host but rather a change in the pathogen. Pathogen organisms, such as fungi, bacteria, and viruses can mutate, that is, undergo abrupt heritable random changes in their genetic make-up. Most of these mutations will turn out to be disadvantageous, but a rare one will confer an adaptive advantage to its carrier, potentially developing it into a new virulent strain. Given the requisite conditions, this strain can quickly spread through the host population as long as it encounters hosts of the same type. Once it runs out of host substrate it may either adapt to a new host or else it has specialized itself out of existence. (This explains why most host-parasite relationships reach some sort of equilibrium in an endemic state).

Since mutations are random events, the more you can produce and test, the more likely you will find one that is adaptive. If, say, you took a large number of fungal spores and plated them out in hundreds of petri dishes containing all the same medium, chances are you would find a spore that could grow on this substrate. If, however, you partitioned this same number of spores among ten different media, you would immediately lower the probability of success, let alone of finding a spore that could grow on two or three of the tested media. Similarly, large acreages of uniform host substrate are more prone to disease outbreaks than small acreages of diverse hosts.

Now, why can't the host organism counter with a mutation that confers resistance against a new virulent pathogen? Actually it can and frequently does, but there is an inevitable time lag which is further accentuated because the host organism has typically a longer life cycle than the pathogen, making it more sluggish in its adaptive response. During the time lag, the host incurs losses and these losses are typically proportional to the uniformity of the host.

Man, the domesticator, has been smart enough to get the hang of these cycles in host-pathogen relationships. Thus, resistance testing has become routine in any plant and animal breeding program. Any new variety that is released has usually been tested against all available strains of important pathogens and under a variety of conditions. Strict regulations and enforcement programs have been adopted by many countries to minimize the introduc-

tion of exotic pests. In spite of these efforts, there has been an endless string of epidemics, some with catastrophic. impact. More importantly, if there was a common denominator between the outbreaks of major epidemics of the past such as wheat rust, the Victoria blight of oat, the Panama disease of banana, the Bengal rice disease and the southern corn leaf blight, it was the genetic uniformity of the host. Clearly, crop monoculture and genetic uniformity invite epidemics.

A Purely Agricultural Problem?

By now, you are probably wondering why I take up space in the *Arboretum Bulletin* to discuss matters that should be the concern of agronomists. The point is that while agronomists should worry about the problem, they cannot solve it alone. It takes an informed consumer, too.

The problem of crop uniformity has concerned plant scientists for a long time and they have devised massive back-up programs such as preserving gene resources in wild species and varieties, identifying varieties with broad-spectrum resistance, and inducing new mutations that either confer resistance in desirable varieties, or desirable traits in resistant varieties. These efforts have been real but apparently inadequate; and in fact, the Committee on Genetic Vulnerability of Major Crops recommends a number of specific, well coordinated measures to fill the breach[1]. But what should concern us here is that these efforts may be largely deflated by the undue reward our free market economy places on a uniform product. As long as we as consumers are satisfied with three apple varieties instead of twenty, and as long as we accept a small price differential as a decisive argument in our purchase, we directly contribute to genetic uniformity. The question is whether what seems sound in our day-to-day economy is equally sound in the long run. As in so many related issues concerning finite resources in a finite space, we may gradually become aware that what is an advantage to a small segment of society may well be a cost to society at large. We have the choice to decide in which form and over what time we want to bear this cost, but we cannot wish it away.

I am reasonably optimistic that we are capable of meeting this challenge in a rational manner. The recent advances in our coping with pollution point this way. More significantly, I am reminded of the time when the supermarket syndrome swept the country, wiping out the corner store and confronting us cheese eaters with a tasteless assembly-line product wrapped in plastic. As you all know, the delicatessen store is back again, in fact it flourishes. The cheese varieties are more numerous than ever, and we can even taste them before we buy them. Is this merely a by-product of our increasing affluence or was it a systematic reaction to what we might call a counter-biological excess of uniformity? Or, more broadly, does our economy obey rules that are ultimately rooted in the biological realm of organic evolution?

If my first point related to our role as consumers my second point pertains to our role as tree growers. Clearly, what holds for crop plants must have a bearing on our trees, too. Indeed it does. Luckily, most of our forest tree species have not yet been subjected to long-term domesticating pressures and are, therefore, still in a near-wild state with abundant genetic variability. Also, their natural breeding mechanisms seem to maximize genetic variation, thereby rendering them less susceptible to depletion in response to uniform selection pressures. Furthermore, most systematic forest-tree improvement programs are of recent enough origin that due attention has been paid to maintaining a broad genetic base.

But there are warning examples, too. Poplar culture in Europe is a case in point. Poplars are grown in large, intensively-managed plantations over short rotations, to be utilized as match stock, veneer, and pulp. There is nothing fundamentally wrong with this intensive culture and in fact, we will see more of it in this country, too. But where the problem arises is that poplar culture is frequently synonymous with *monoclonal culture.* In other words, large acreages are usually planted with trees of a single clone, all having been derived through vegetative propagation from the same original tree and thus all being genetically identical. And since some of these clones, because of their phenomenal performance, have received

wide publicity, they have been quickly adopted by many land owners and eventually covered extensive areas in many neighboring countries. This has been going on over more than a century but on a large scale mainly since World War II; in any event sufficiently long for certain pathogens such as *Aplanobacterium populi,* a bacterial canker, *Melampsora* rust, or more recently *Marsonnina brunnea,* a leaf disease, to adapt to such "miracle" clones and periodically to wipe them out. The problem is significant enough that the European Common Market countries have launched a coordinated program of resistance testing and systematic broadening of the genetic base in poplar breeding. It may be of interest to know that what many view as a weed species in the Pacific Northwest, our native black cottonwood, is considered a prime source of desirable genes for this program.

The lesson we can learn from the poplar story is that *vegetative propagation* of trees, if practiced without restraint, may seriously affect the life expectancy of the particular cultivar. The lesson is of particular significance to those of us concerned with fruit trees, shade trees and ornamentals, because vegetative propagation is, of course, the normal route by which these trees are multiplied. No matter how sweet a given apple, how shapely a maple, and how smog resistant a given oak may be the more copies we produce of that given type, and the more we crowd them together the greater the chance of eventually eliminating them. It seems therefore, particularly short sighted that in many eastern and mid-western cities the dying American elm has been replaced by a single mutant form of Honey Locust, *Gleditsia triacanthos* f. *inermis.*

We must see to it that variation prevails in our urban planting programs: mixes of species, mixes of varieties, mixes of clones! Or else, we had better be prepared to pay the price.

As I began my story with an analogy, I might as well end it with one, too. Uniformity in plants seems to be as short lived as we might predict it to be in people. A world of Einsteins and Sophia Lorens, exciting as it might be, would hardly make for a stable society nor a secure future. After all, who would mend my socks?

References

1. *Genetic Vulnerability of Major Crops.* National Academy of Sciences. Washington, D.C. 1972.
2. *Classic Papers in Genetics.* J. A. Peters, Prentice-Hall, Inc. Englewood Cliffs, N.J. 1959.

R. *russatum* 'Cantabile' Photo: Don Normark

Dwarf Rhododendrons for the Rock Garden

*BETTY CAPERCI**

Have you considered rhododendrons for your rock garden? Although numerous articles have been written on various plants for the rock garden, too few are about one of the most choice, namely, the dwarf rhododendrons. Thus, many people neglect to include some of the little jewels when they are creating their masterpiece. A few dwarf rhododendrons would provide accent areas and add great beauty to the overall picture.

A misconception exists pertaining to the definition of "dwarf" in regard to rhododendrons. Some are called "dwarf" that in reality are not truly dwarf. The very largest of the true dwarfs never will reach over three feet in their lifetime. Many of them will only grow a few inches high, and will spread into lovely, compact mats. In fact, some of them could be called "creepers."

Only two of the dwarf rhododendrons that I can think of are stoloniferous, but never invasive: R. *pemakoense* and one of its hybrids, R. 'Rose Elf.' Being stoloniferous only adds to their ability to spread into more compact buns. No dwarf rhododendrons will ever "take over" any of its neighbors in the rock garden.

The other advantages of using dwarf rhododendrons are numerous. Most of them are evergreen, though in some plants the foliage changes colors with the seasons. They have small foliage, and grow slowly in the rock garden. And color of bloom? They come in all colors of the rainbow! Because the best known one, R. *impeditum,* and several others bloom in shades of lavender or purple, many people do not realize the full scope of their color range. We have a form of R. *impeditum* that has a

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*Mrs. James Caperci and her husband are well-known hybridizers and rhododendron growers in the Pacific Northwest. They specialize in alpine or dwarf varieties.

rich, deep purple flower. R. *intricatum* is about as good a blue as a flower can be. Another form of R. *intricatum* has such a soft, delicate shade of lavender that one almost expects it to have the odor of lavender. R. *calostrotum* is a bright magenta. Many people do not like magenta, but the foliage of this plant is something else again! It is one of the loveliest grey-blue, with rusty-colored indumentum on the under-side of its small leaves. The bright magenta flowers are most attractive contrast against the foliage. Those who say they do not like that color are the very ones most likely to acquire this plant when they see it!

Originally coming from above timberline in the very high rugged, tough mountain areas such as the Himalayas, dwarf rhododendrons are understandably very hardy. As most rockeries and rock gardens are sunny, here too is another reason why these small gems should be included in the planting. If given too much shade, these dwarfs will put too much of their energy into leggy growth instead of flowers. Their roots do like to be fairly cool and moist, so they love to snuggle among rocks. Care is at a minimum. The main point to remember is that any rhododendron needs water and good drainage. Roots should never be allowed to dry out, but the drainage is seldom a problem in a rock garden.

The plant itself, not the bloom, is the main thing to consider when choosing a dwarf rhododendron — or any other plant for that matter! It is the plant one looks at for most of the year. Flowers are just a wonderful added bonus to a lovely plant. Hence, plants should be chosen for their foliage, habit of growth, and continuity with the others with which they will be growing. The blossoms will be an exciting surprise after the plant has been enjoyed the rest of the year. Incidentally, some of the dwarf rhododendrons bloom in the early fall as well as spring, doubling the bonus! R. *chryseum,* a lovely golden yellow, is blooming as heavily now (mid-October) as it did last spring. Depending on the weather, of course, by choosing certain varieties one can have some bloom in the rock garden from dwarf rhododendrons from February to June or July. Some will bloom so profusely that it is difficult to see the leaves. Many of them bloom when they are so tiny it is hard to believe.

Size of the flowers varies as greatly as does the color range or the foliage: the tiny, pure white, flatish bloom of R. *microleucum,* or those that have small, round, ball-like trusses of tiny flowers such as R. *intricatum* (blue), R. *impeditum* (lavender to purple), R. *chryseum* (yellow), R. 'Maricee' (selected form of R. *sargentianum,* white or light pink) or the shades

R. *pemakoense* makes a delightful rockery plant. Photo: E. F. Marten

of pink to red and also pure white of one of my favorites, R. *kiusianum,* a native of Japan. Many varieties have bell-shaped flowers. Among them are three of our own creations: R. 'Kim' (pinkish turning to yellow), R. 'Bobette' (yellow), and R. 'Patricia' (ruby red). The earlier mentioned R. *pemakoense* and R. 'Rose Elf' are among those with larger, more open bells. The well known R. *forrestii* var. *repens* brightens any spot with its good-sized clear-red tubular bell. Deeper red is R. *chamaethomsoni,* and even deeper is R. 'Carmen.' Similar shape of flower is found in R. *myrtilloides* (plum-pink), R. cremastum (old rose), and others. Some have flatish, pansy-like flowers that seem to stand up and look at one: R. *radicans,* R. *keleticum* and R. *prostratum* to name a few. R. *chrysanthum* has larger creamy-yellow trusses, as does R. *hanceanum nanum,* which also has beautiful, bronzy new growth.

Who could resist having a plant of R. *williamsianum* in his rock garden? It has everything one could ask for in a plant: small round leaves, chocolate-colored new growth, compact habit, beautiful clear pink cup-shaped flowers. It is understandable that is a favorite of hybridizers. If perfectly happy in its environment, it will bloom profusely. I must confess that in one way it is like some people. If it is not satisfied with where it is growing, it will sulk a bit, and not perform up to expectations by giving out only a few blooms. We have plants over twenty years old that measure a foot high and two feet across, so that one does not need to worry that it will outgrow his rock garden.

One of the most perfect of rhododendrons may not be considered for a rock garden. Yet, in the wild it takes it a couple of hundred years to reach four feet high. Perhaps R. *yakusimanum* is felt to have larger leaves than usual for a rock garden plant but is has no faults for us. It is one of the most beautiful foliage plants, the leaves being a very rich green, the underside covered with thick felt-like indumentum of silvery tomentum. The flower itself reminds one of an old-fashioned nose-gay. When the bud first opens, it is a bright pink which gets paler as the flowers open more fully. When in full bloom it is pure white. Can you resist owning one?

As mentioned earlier, the care of dwarf rhododendrons in a rock garden is minimal. The roots should be kept damp, not wet. They need good drainage. And please, take it easy with the fertilizer! Good common sense tells that a little plant six inches high does not need the same amount of feeding as a plant six feet high, even though the tiny one may be much older than the big one. A little dose of T.L.C. and these jewels of the plant world will love you for it, and show it!

Dwarf rhododendrons are a "must" for your rock garden. If you do not have them, you are really missing something! ▲

R. *yakusimanum's* beautiful foliage and apple blossom pink flowers make it a star performer in any rock garden.

Photo:
B.O. Mulligan

*The Garden's Mission in the Decade Ahead**

Dr. Howard S. Turner, President of The New York Botanical Garden has written an editorial appearing in the February 1973 issue of that organization's* **Garden Journal. *Because the article contained information equally pertinent to our own Arboretum, the Editorial Board requested and has received permission to reprint a portion of it here.*

. . . the Garden from its inception has enjoyed generous support from diverse sources, public and private. Since World War II, governmental support has increased and in recent years an effort was begun, and is continuing, to engage the active participation of the business community through a campaign of annual giving. The Garden's audience has always been the public at large, but now a new focus is on the citizens of New York City, whose mounting needs for Garden services are paid for in part with funds from the City government. As a scientific and educational institution, the Garden has always drawn its staff and administration from professional ranks, but throughout the eight decades of its existence has been grateful for the active and valuable collaboration of interested volunteers. It is our hope and desire that this balance will continue, for the Garden's broadening role in a rapidly changing society and its mission in an ecologically unbalanced world still will require the fullest possible measure of support.

Traditionally, the Garden's mission has been to explore and explain the role of plants in the fabric of life, from scientific, horticultural, and aesthetic points of view. Displays (indoor and out), educational programs, public service activities, and research have reflected this concern. The Garden's superb reputation in advancing and sharing knowledge about plants is international in scope. These pursuits shall and must continue.

The new challenge before us is to carry the pursuit one step further and apply our knowledge of plants for the benefit of society. We must *demonstrate* — and at all levels, scientific, educational, and aesthetic — the importance of plants to mankind. This is manifest involvment, ranging from the preparation of environmental impact statements, living-resources management plans, and the training of environmental diagnosticians to the development of practical "for instance" horticultural displays for apartment dwellers and home owners, creation of plantings which show the keenest sensitivity to the relationship between plants and land form, and the fullest use of the world catalog of plants.

No longer can the Garden be regarded merely as an ornamented park for diverse recreational activities. It is at once a museum, a special kind of open space, a permanent field station, and an outdoor laboratory, where people can find satisfaction and solace, where they can discover much about their natural heritage, and where they can be inspired to make wise use of the heritage. The Garden's success, and therefore its future support, will be measured by its effectiveness in advancing, sharing, and applying knowledge of plants for the benefit of all facets of society. ▲

Dr. Richard A. Howard of Weston, Director of the Arnold Arboretum, Jamaica Plain, was recently named president of the American Association of Botanical Gardens and Arboreta at its annual meeting held in Los Angeles. Founded in 1940 with the Arnold Arboretum one of the charter members, Dr. Donald Wyman, former Horticulturist at the Arboretum, was the organization's first president, holding that office from 1940 to 1945.

The Arnold Arboretum, the oldest public arboretum in the United States, is administered by Harvard University and the Boston Department of Parks and Recreation. Its two hundred sixty-five acres contain 6000 varieties of ornamental trees and shrubs from the North Temperate zone.

Here Come the Arboretum Ladies!

*JEAN HENDERSON**

Doris Taggart shares her treasure box with eager youngsters at Newport Hills School in Bellevue.
Photo: Joy Spurr

"It's wonderful to go into the classroom and see the children's delight that you are there," says Doris Taggart of the Arboretum Foundation Unit Council's School Visitation Program.

The program was begun under the Volunteer Services of Community Resource Bureau in 1969 by Dora Murphy (Mrs. Robert). It was announced as part of the Unit Council Guide Program by Mrs. John Allen at the September 18 Governing Board meeting that year. Sample treasure boxes were taken to classes where the volunteers identified native plants, told of Indian or pioneer or present uses of plants.

This year's director, Mrs. Taggart is enthusiastic about the program that takes her and many other volunteers to schools over the greater Seattle area to tell elementary pupils about plants and the Arboretum.

"I think the most wonderful things about it is the response of the children," she states.

The children respond in various ways, but Mrs. Taggart especially recalls their bright eyes in the classroom and the laboriously-written thank you notes that follow the visits. Almost all of the thank you's carry the same theme: "Thank you for the plants. I wish you could come back soon."

The school program has expanded to include districts in Seattle, Bellevue, Mercer Island, and Edmonds. Last year 27 different class-

*Jean Henderson is Public Relations Consultant for the Arboretum Foundation.

rooms were visited. Much of the program's growth has come about because teachers recommend it to others.

Each presentation is tailored to the teacher's request. Teachers are asked in what direction they would like the program slanted and are quizzed about what things the children have already learned about the subjects to be discussed. If a special interest program is requested, such as a discussion of identification of poisonous plants, then Mrs. Taggart seeks out Unit Council members with this particular knowledge.

Generally, however, the program emphasizes native plants, relationships to environment, and Indian and pioneer uses of plants.

The Arboretum Ladies, as they are called by the youngsters, arrive in the classroom with freshly-cut and dried specimens (the latter prepared for them by the Herbarium Committee). They spend about an hour discussing native conifers, deciduous trees, shrubs, and ground covers. Questions from the young students are encouraged and specimens are passed around for all to feel and smell.

Visits are not necessarily limited to one time. Sometimes a teacher requests a series of talks and many times the school program is followed by the class's visit to the Arboretum itself. In this, as well as the training of the volunteers, Arboretum Ladies work closely with the Guide Program.

Mrs. Taggart recalls one class to which a series of visits was made, during which the children studied the Arboretum in detail, and drew maps of it. When these youngsters toured the Arboretum, they quickly recognized Rhododendron Glen, Azalea Way, Woodland Garden, and other areas and squealed with delight at each discovery

Effects of pollution on plants are often pointed out as the youngsters tour the Arboretum. Children may also learn that sticks deteriorate and help feed plants, but that bottle caps, paper, and other litter detract from the Arboretum's beauty. One group started its own clean-up campaign as they walked, carefully depositing all the trash in an appropriate container when they completed the tour. Two children then announced that they were going to make posters to tell others how litter hurts.

Nine volunteers conducted the school programs last year. These include the special interest speakers called upon for their particular knowledge of a requested subject. Mrs. Taggart says there were also eight participants in the combined training program with the Native Walk guides last fall.

As she thinks of the volunteers' efforts, Mrs. Taggart keeps remembering the joys they have shared in presenting programs in classrooms. In one school they visited handicapped children, some of whom could not even walk.

"They were so delighted to see us and their eyes were so bright," she recalls. "One little boy left the room and when he returned he just stood at the door and said aloud, 'Oh, this room smells good! It smells green!' "

"It's a program about our environment and natural resources," Mrs. Taggart concludes. "And these are the things of which everyone should be made aware."

Trees . . . have at once a humbling and uplifting effect on men. In some mystical way they seem to strike a spiritual chord in us and to make an appeal for serenity, sanity and wisdom.

C.R. Ranganathan, Fifth World Forestry Congress
Dr. Henry Schmitz, The Long Road Travelled
p. XXI

HAVE YOU ORDERED YOUR COPY?

The Arboretum: People, Programs a

Photo: Joy Spurr

Photo: Joy Spurr

Assisting the staff ir
and adults alike from t
trained volunteers. The
Arboretum indoors and
At the extreme left stude
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Christofferson leads a
(right) and gives them b
species of deciduous an
materials. Sometimes a b
Similar guided tours ar
At ten o'clock in the m
month, the Arboretum
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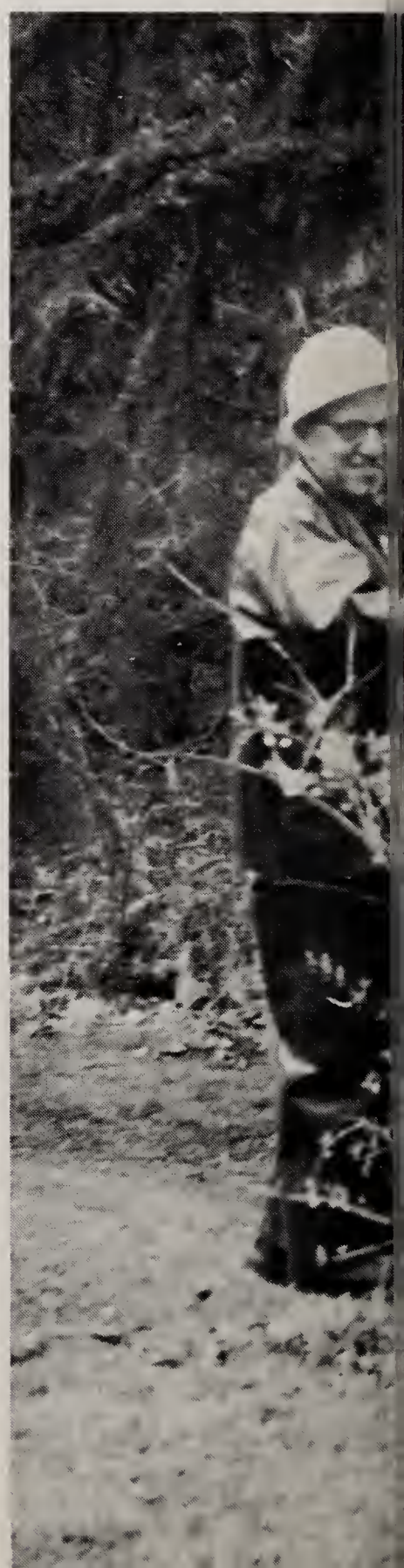
Photo: Joy Spurr



d Plants

terpreting our Arboretum to children urrounding community are many well hool Program (pp. 12-13) brings the ches the lives of countless youngsters. from Newport Hills School in Bellevue by the Arboretum Ladies. Irene up of students on the Native Walk ical information on approximately 25 ergreen trees, shrubs and groundcover Northwest history is added for spice! ailable through the Japanese Garden. ng on the fourth Wednesday of every lorers invite others to join them on a area of the Arboretum having color time. Here Bob VanDenburgh, recent- for the Arboretum, identifies plant p of Explorers.

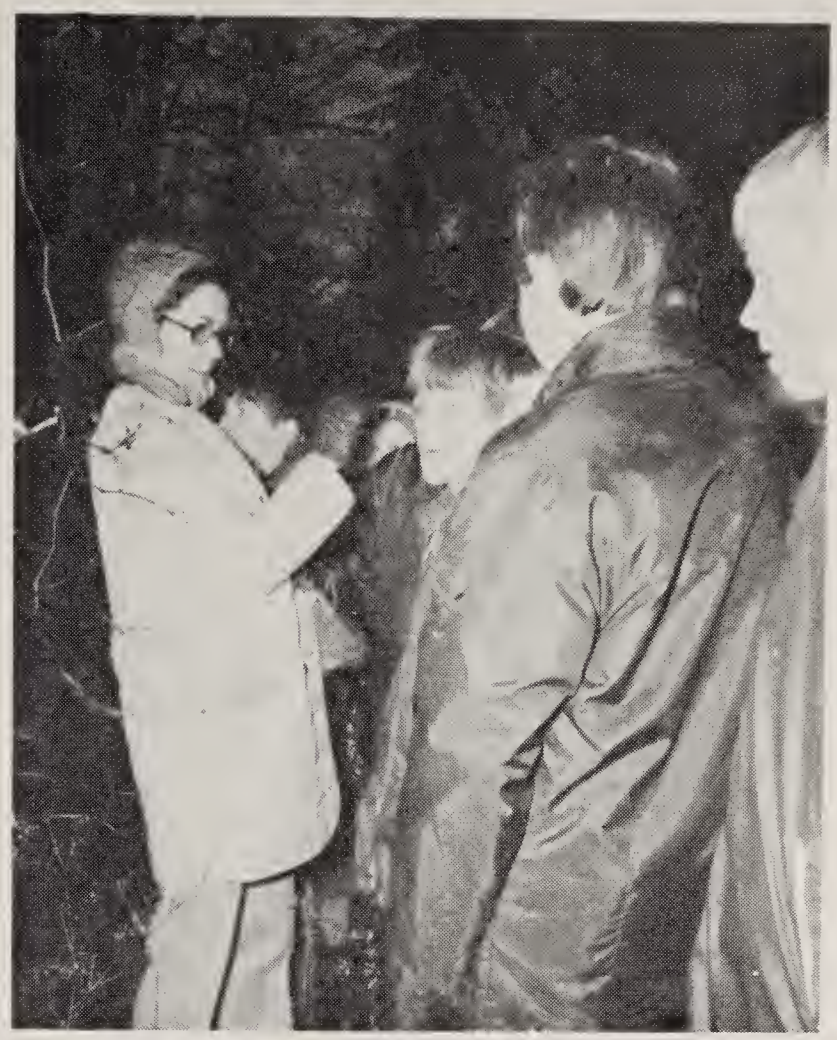


Photo: Marge Parrington

Arboretum Classes

Arboretum courses scheduled by the Collge of Forest Resources for fall quarter include both beginning and intermediate bonsai culture, birds of the arboretum, fall tours, and pruning ornamentals. Further information and registration blank will be available in SPECTRUM — due for distribution the last of August. SPECTRUM is sent free of charge to those on the Continuing Education mailing list. You can place your name on this list by calling 543-2590.

Have you purchased your copy of the Symposium booklet from the Arboretum office? Other botanical directors and leaders think our Arboretum is a very special place. Their thoughtful contributions on Arboretum management should be read by every member of our Foundation.

This is your Arboretum, kept alive by your support

We are pleased to welcome the following new members (January 1, 1973 through March 31, 1973):

Sustaining — Mr. & Mrs. Ted Marks. *Annual* — Mrs. J. D. Addison, Mr. & Mrs. Robert Barnes, Mrs. George H. Bartling, Mrs. Bill L. Bell, Mrs. Bruce T. Berglund, Mrs. Ray H. Bothel, Mrs. Philip Cartwright, Mrs. G. M. Christensen, Mrs. Lyle M. Clark, Mrs. Bernard Conrad, Rebecca Cook, Mr. & Mrs. A. D. Cornell, Mrs. Dennis C. Davidson, Mrs. Herbert Day, Mrs. Frank R. DeBruyn, Mrs. John W. DeCoste, Mr. & Mrs. Ben Dotson, Edmonds Community College, Mrs. W. A. Fleener, Mrs. Edward L. Folsom, Mrs. Walter Fontaine, Mrs. Richard L. Foster, Mrs. David G. Fryer, Mrs. Don Glad, Mrs. John T. Graves, Jr., Mrs. Philip D. Hamlin, Mrs. Richard M. Hammett, Mrs. Donald Hellbaum, Mrs. John H. Hill, Miss Mary B. Holt, Miss Carol Hooey, Isaac R. Hunter, Mrs. Gordon James, Mr. & Mrs. James T. Johnson, Mrs. George Z. Kennaugh, Miss Muriel Kennedy, Mrs. Frank Killien, Mrs. William Kirschner, Mrs. Robert Knappe, Mrs. C. Calvert Knudsen, Mrs. Robert Langland, Mrs. Jesse L. Lockyer, Mrs. John C. Lowe, Mr. & Mrs. Harold Luiten, Mrs. Howard R. Martin, Mrs. Matthew Martin, Mrs. William G. McMeekin, Mrs. Lewis S. Miller, Mrs. William Moore, Mr. Harold A. Newsome, Mrs. George C. Oistad, Jr., Mrs. Tom Osborn, Mrs. Elva Jo Paget, Mr. & Mrs. Everett P. Paup, Mr. & Mrs. Robert T. Penley, Mrs. John Rawlings, Jr., Mrs. Ronald Reed, Mrs. William A. Ritter, Mrs. C. E. Robertson, Jr., Mr. George Ryan, Mr. Bruce Sanford, Mrs. Ivan L. Settles, Mrs. Charles L. Shaw, Mrs. Russell Sheldon, Mrs. Dorothy N. Solana, Mrs. John Strauch, Mrs. R. S. Taylor, Mrs. Catherine Thompson, Mrs. Leslie D. Turner, Mrs. Ruth M. Wakefield, Mrs. Robert W. Wheeler, Mrs. J. Knox Woodruff, Mrs. Richard Zue.

Magnolia sargentiana var. robusta. Photo: Joseph P. Butler

Arboretum Spotlight

Magnolia sargentiana var. *robusta*

This is unquestionably one of the most handsome flowering trees in the Arboretum at any time of the year, but coming as it does in March or early April when there is no similar competition save its less hardy relative, the Himalayan *Magnolia campbellii,* and opening its immense flowers on bare branches, it is indeed a striking object, particularly when placed in front of some evergreen trees such as our native Douglas firs.

The Arboretum is fortunate to possess half-a-dozen of these splendid trees placed in various situations in the eastern half of the area where they can enjoy the sandy type of soil and good drainage which they need as well as some shade in the afternoons in summer. One of the two largest can be found beside Arboretum Drive E. at the head of Rhododendron Glen, facing the parking area and drinking fountain. This tree was planted in March 1958 and first flowered in 1967. It was derived from scions given in 1952 by the late Donald G. Graham of Broadmoor, who was probably the first person to introduce this tree to the Seattle area, by importation from England. The second largest came from a garden at Eugene, Oregon, an eight foot tall plant in March 1956. It is placed on the bank above the trail leading to the Look-Out, on the south side of Rhododendron Glen. First flowering occurred in April 1969.

When fully developed the flowers are about ten inches across, as large as those of *M. grandiflora*, in color a pale lilac-pink, by no means as bright or deep a rose pink as those of *M. campbellii.* The tree, however, is much hardier, and has successfully endured a number of cold winters which have damaged the bark of the latter species.

Since it can grow to 40 feet or more under

(continued on page 19)

Weather Report, Arboretum, 1972

	Rainfall	Average (21 years)	Temp. (F°) Max.	Minutes	Sunshine (at airport) hours	% of possible
Jan.	6.03 ins.	6.63 ins.	49	8	62.8	23
Feb.	5.63	4.35	59	18	76.7	26
March	6.78	3.97	68	28	139.0	38
April	5.15	2.81	81*	30	206.2	50
May	0.54	1.84	90	32	226.2	48
June	2.61	1.65	84	42	217.7	46
July	0.82	0.74	91	46	354.1	74
Aug.	1.12	1.21	89	48	324.9	74
Sept.	3.33	2.15	85	34	178.2	47
Oct.	0.65	3.48	70	30	145.1	43
Nov.	3.45	6.03	60	31	86.6	31
Dec.	9.33	6.32	54	9	60.0	23
Totals	45.44 ins.	41.18 ins.				

*Recorded April 27; next highest figure on 23rd, 70°F.

Except for 1968 (51.60 ins.) this was the wettest year since 1953 (46.40). Over 36 inches fell in the six months January through April, and November-December. May and October were unusually dry, and like July recorded rain on only five or six days of each month.

The coldest portions of the year were first in late January when the maximum temperature between the 23rd and the 31st ranged from 35°F. down to 22°F., and the minimum for 29°F. to 8°F. Snow also fell at this time, eleven inches being measured at the airport. Secondly, in early December (3 through 13) when the maximum was between 25°F. and 34°F., and the minimum 9°F. to 32°F. A north wind of from 5-14 m.p.h. also added considerably to the cold factor and its effect on evergreen plants. A small amount of snow gave little protection. Considerable damage resulted to many plants, especially those from the southern hemisphere (*Eucalyptus, Leptospermum, Nothofagus, Escallonia*), to the *Ceanothus* collection, pines from Mexico, and natives of the Mediterranean region (*Cistus, Rosmarinus, Arbutus Unedo*). The effects of two cold periods in twelve months is cumulative and more severe than we usually experience.

The extended hours of sunshine in July and August evidently played a major part in the exceptionally heavy blooming of the spring flowering trees and shrubs this year, e.g. the *Prunus* family, *Rhododendron sutchuenense* and others, and almost all the magnolias, especially the beautiful Chinese Yulan (*M. denudata*), and the various forms of the hybrid *M. X soulangiana*. The average maximum temperature at the airport during August was 2.6°F. above normal.

B.O.M.

Editorial comment: The summer issue of the *Arboretum Bulletin* will include a compilation of data from several areas of Oregon detailing the effects of the colder than usual winter and the effect of it upon plant material.

SOME OF OUR FAVORITES
Won't You Send Us Yours?
R. 'CILIPINENSE'

*HELEN CHILD**

What could be more appealing in the grey days of late winter than a lovely, apple blossom pink rhododendron — its bright blossoms seeming to hold the promise of spring! There are many early blooming rhododendrons which surely are harbingers of the profusion of color a garden has to offer as the spring months arrive. In fact there are so many beautiful varieties that it's difficult to name a favorite, but surely R. 'Cilipinense' has to be a choice of mine.

I was first introduced to this pretty flower at a Garden Club horticulture meeting and immediately sought a plant for my garden. Since then we've been richly rewarded with its delicate blossoms early in March when everyone is anticipating the sunshine and bright days of spring. The lovely blossoms of R. 'Cilipinense' are especially appreciated after winter has seemingly lingered too long. The rest of the year the plant is a strong addition to any flower bed with its lustrous, green leaves and their attractive sheen. This hybrid is a cross between R. *ciliatum* and R. *moupinense* and is described as a semi-dwarf that will withstand temperatures to five degrees. However, if there is frost at blooming time, it is best to give the buds some protection from the cold.

I'm sure anyone acquainted with this dainty rhododendron would agree that it's a brilliant addition to a Northwest garden where it may find such a very special welcome. ▲

*Mrs. Gerald F. Child is a Tacoma member of the Foundation Board of Directors.

(continued from p. 17)

favorable conditions and is bushy in habit, occupying considerable space, it is not a tree for a small garden, but where space is available and it can be suitably placed and sheltered from wind it will indeed prove an excellent investment and give pleasure for many years to come. This tree was introduced by E. H. Wilson from western China in 1908 to the Arnold Arboretum.

B. O. Mulligan

UNIT CONVERSATIONS

A selection of northwest native tree seeds was presented to the Kobe Municipal Arboretum in October in Kobe, Japan by members of the University of Washington Arboretum Foundation to honor the fifteenth anniversary of the Kobe-Seattle sister city affiliation. The delegation, twenty-nine Arboretum Foundation members, was led by Marguerite Sherman (Mrs. Dallas K.) chairman of the Japanese Garden Tour Guide Program. Mrs. Robert Sprague, a Foundation member since 1939 and president of the first unit, made the presentation to Deputy Mayor Manabe Kano of Kobe. Mr. Kanomitsu of the Office of Foreign Affairs in Kobe presented Mrs. Sprague with a gift for our Arboretum – eight packets of maple seeds which have been planted. While visiting the Kobe Arboretum, all members of the delegation took part in the planting of seeds of *tsuga heterophylla* (Western hemlock), *pseudotsuga menziesii* (Douglas fir) and *abies magnifica* (California red fir) in an area designated as the "Seattle Forest."

Following a January inventory, Unit Council Greenhouse chairman Ruby Williams (Mrs. W. E.) reported 2,992 plants for the Spring Plant Sale! The purpose of the Greenhouse committee is to raise the unusual, the popular requested plant, and cuttings of selected Arboretum grown material provided by the Arboretum staff. There is always room on Tuesdays for volunteer workers to help take cuttings and care for plants in the Patricia Calvert greenhouse. This is an excellent way to learn plant material and the use of a greenhouse. A book *Cuttings Through the Year* prepared by our greenhouse gals and published by the Arboretum Foundation is available in the Foundation office.

Memorials in the form of donations are a fitting tribute to those who have devoted their time and energies to further the development of the Arboretum. Contributions should be made to the Arboretum Foundation Memorial Committee and may be ear-marked for specific purposes. Recently the Unit Council Herbarium Committee received a donation in the memory of Dorothy Schwager (Mrs. John). They plan to build a permanent herbarium display board. Unit 16, the Myrtle DeFriel Unit, gave a gift in memory of Mrs. DeFriel's husband Jay. It will be used in the Unit Council Greenhouse.

Phyllis Morgan

We wish to extend a great big THANK YOU to all you hard-working, stalwart, and sometimes soggy workers who turned out for Work and Fun on both April 18th and May 14. Your many hours of time and "talent" spent improving our arboretum will be appreciated by members and visitors this coming season. Many thanks to all of you.

Lee Clarke and Bev Smith, Co-chairmen

ENVIRONMENTALISTS! GARDENERS!

Owner wants *you* to have this three bedroom contemporary house in north end, beautifully sited on two-thirds wooded acre that includes two extra building lots. Formerly featured in *Seattle Times* as *home of well-known landscape architect.* Will be shown by appointment.

486-6137 Evenings

Book Reviews

MULTI-SEASON SHRUBS AND TREES, by Richard Gorer; Faber & Faber, London; $8.75.

Mr. Gorer describes 530 species, alphabetically, which have attractions in addition to their flowers, i.e., bark, new wood, new foliage, autumn color in foliage or fruit. He does this with interesting information about each one, but without being too "wordy". He does not mention one of my favorite attractions, branching structure or pattern, and I could wish for more of the excellent black-and-white photographs, but I can forgive him these for the very useable tabulated list at the back of the book showing, at a glance, the attractions of each plant (other than fragrance). There is also a list of common names for some of the genera and species. The author gives some valuable cultural tips in the introduction which, though applying to Britain, would not go far afield in the Pacific Northwest. It is an altogether enjoyable book!

M. W. BAIRD

NATURE AS DESIGNER: A BOTANICAL ART STUDY, by Bertel Bager; Van Nostrand-Reinhold; 1966. 176pp., 191 text photographs; $14.95.

Dr. Bager is a Swedish surgeon who makes open love to Nature, a practice which in America is regarded as an idle amusement, if not a downright waste of time. He is attracted to the shapes of fruits, seeds and their capsules, the wings and hooks that serve to distribute seeds, and the patterns which are left on stems when the seeds have fallen away. He is attracted by the marvelous fit of plant structures to their functions and by their economy of materials, both being adaptations to survival of the species.

He preserves his collected specimens dry or in pickle in a cabinet which he calls a "fructarium," then mounts them for photography on little pedestals of modeling rubber. Many of the specimens are from the countryside of Sweden; they represent circumboreal plants which also live wild in Washington. A few specimens of unusual interest are borrowed from museum collections or are taken, with permission, from arboretums.

The book is essentially an atlas of photographs with extensive captions. One of the subjects is the fruit of a tropical plant, *Lecythis,* as big as a baby's head, reproduced on a full page at natural size. Many subjects are magnified from two to eight diameters. The photographs are black-and-white, reproduced by a fine screen process which emphasizes form and texture. Color would have been prettier but would have drawn attention from the shapes which the author wants to emphasize. I like his photo techniques. He uses point-of-light illumination for smooth subjects and diffuse illumination for rough ones. The use of back-lighting provokes imagination; it is not an explicit, textbookish way of illustrating plants. Though the author has collected a few seed pods that look like snakes, pigs, or birds, and has heightened the illusion by posing them as snakes, pigs, or birds, his departures into whimsy are few. To photograph a hundred similar subjects and yet maintain variety was not an easy task. The more one studies the results, the more one respects the author for his success in avoiding monotony.

The title of the book notwithstanding, I believe that Dr. Bager is more architect than artist, for his pictures are clean and precise, balanced and purposeful. Artists will see beauty in them but not that element of uncertainty — that searching for something beyond the visual and felt — which characterizes art.

Victor B. Scheffer
14806 S. E. 54th St., Bellevue, WA 98006

North West Companion Planter

From pygmy goats to ladybugs and slugs, **Northwest Companion Planter** is the Pacific Northwest's only regional magazine on organic gardening and agriculture. Experienced gardeners tell how they use organic fertilizers, compost, biological pest controls, companion plants, and natural pesticides. Interesting photo essays on topics such as indoor herb raising, small livestock, and organic growers. Articles for rural, city and indoor gardeners.

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